IEEE 802.16 Presentation Submission Template (Rev. 8.3)
Document Number:
    IEEE S802.16e-03/01
    Date Submitted:
    2003-01-12
Source:

Vladimir Yanover	Voice:	+972-36457834
Alvarion Ltd.	Fax:	+972-36456262
11/5 Shtern Str.	E-mail:	vladimir.yanover@alvarion.com
Herzlya Israel		

Venue:
    Meeting #23
Base Document:
    IEEE C802.16e-03/01 http: ieee802.org 16 igr_contrib C802.16e-03_01.pdf
    Purpose:
    The document is intended to be presented to 802.16E TG

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Handover in 802.16e MAC

Vladimir Yanover

Alvarion Ltd.

Service Definition

- Home IP network identification
  - specifies IP network to which the SS belong. It means that when the SS roams from one BS to another, an IP stack located on the top of Packet Convergence Sublayer (see [1] , "5.2 Packet Convergence Sublayer") stays unaware on the roaming
- QoS Parameters for wireless communications

Service Definition

- Service is kept when changing the location:
  - Home IP network identification
    - specifies IP network to which the SS belong. It means that when the SS roams from one BS to another, an IP stack located on the top of Packet Convergence Sublayer stays unaware on the roaming
  - QoS Parameters for wireless communications

Main Features

- Terminal Assisted HO (MAHO)
- Intra- and Inter-BS HO
- HO Initiated by either terminal or BS, authorized by the network
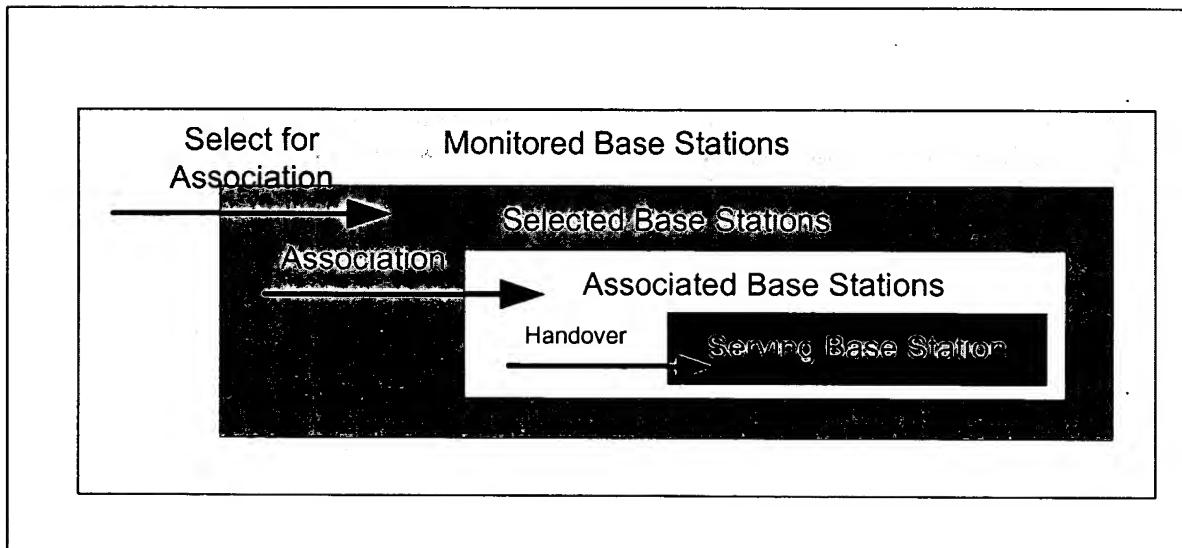
Measurements

- Vacation Periods
  - SS periodically leaves the cell for an integer number of frame durations
  - at the Vacation Period SS tries to receive DL transmissions from neighbor base stations and in some cases communicates to them on Association ("visits" the neighbor BSs)
  - Serving BS is responsible to arrange for the SS vacation periods with no data transfer scheduled between the SS and BS

Measurements

- Visiting neighbor base stations
  - Initial list of HO candidate BSs broadcasted by each BS
  - Visited BSs allocates MAINT transmission opportunities (TOs) for Association of visitors
- Measurements Results
  - The list of parameters measured while a SS visits a BS, is TBD. It will include certain PHY parameters (like RSSI, SNR) and system parameters like service availability at the visited BS.
- Results of measurements are transferred to the serving BS. Serving BS may share this information with other BSs (MC)

Sets of Neighbor BSs

Sets of Neighbor BSs

- Detected BSs
- Monitored BSs i.e. those that are visited for passive measurements
- A subset of Monitored BSs is defined as Selected (for Association attempts)
- After Association, the BS becomes an Associated. Association is performed with limited number of neighbor AUs (see 5.5)

Sets of Neighbor BSs

- After completion of HO (Network Entry) the BS becomes Serving
- Upper layers at BS should include functions for authentication of SU and authorization of services through external server (functional equivalent of HLR at GSM/3G)
- Network should support mobility by changing the routing path for the IP datagrams

Association Procedure

- Visiting each Selected BS, the SS performs Association procedure similar to 802.16 Network Entry procedure:
  - Scan for downlink channel and establish synchronization with the BS
  - Obtain transmit parameters
  - Initial ranging
  - Negotiate basic capabilities
  - Authorize SS and perform key exchange
  - Negotiate availability of services allocated to the SS
  - Perform pre-registration
  - Transfer operational parameters
  - Information on Association is reported to the Serving BS

Neighbor BS Operations

- Respond to Ranging: with transmit power correction, time and frequency offsets
- Authentication of the terminal
- Check whether the terminal is authorized for certain services; setup of security association
- Pre-registration (as guest) including authorization of services [service meanwhile are not enabled]
- Optionally triggering TBD procedure for micro-mobility support (network level)

Serving BS Operations

- Serving BS
    - Collects measurements information and Association information received from SS
    - Performs measurement of signal received from SS
    - Makes decision on HO of the SS to another BS and executes the decision

Handover Decision

- **[Hard] Handover decision** is made by the SS after loosing effectively connection to serving BS
- **[Soft] Handover decision** is made by the network (BS/MC) according to link quality at the given cell and estimated link quality at neighbor cells.
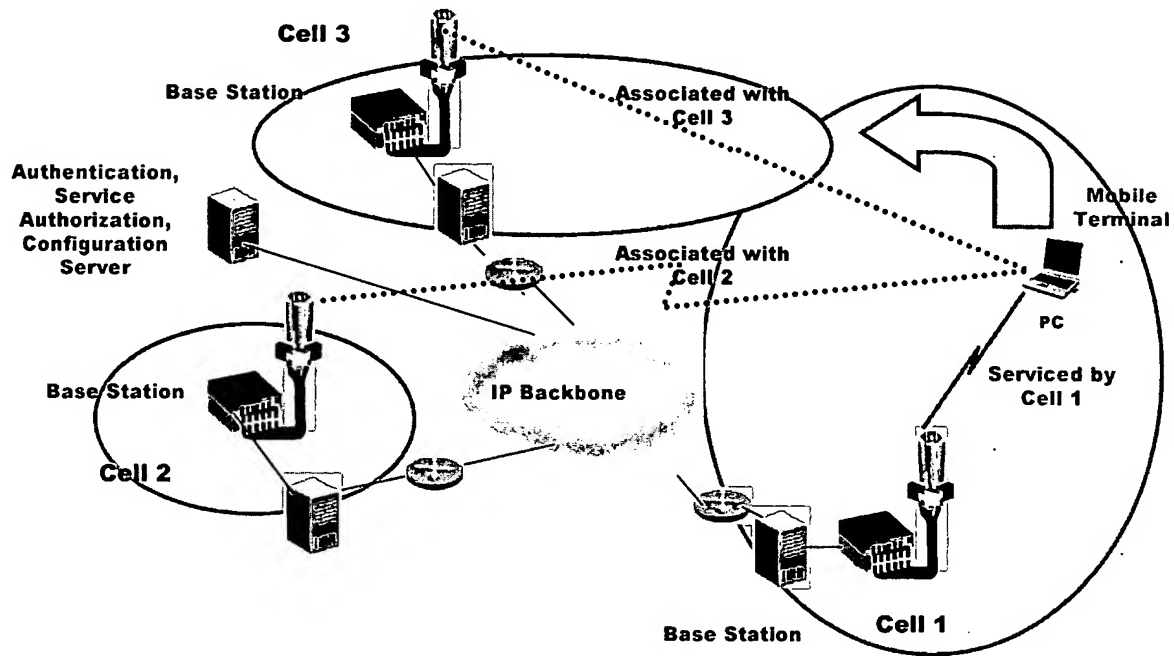
HO Execution

- SS decides on HO to one of the Associated BSs, alone or together with the network
- The SS performs the rest of Network Entry procedure:
  - Informs the old BS and leaves
  - Jumps to the new BS's frequency and timing
  - Adjusts synchronization to DL

HO Execution – Cont.

- SS Informs the new BS on arrival using one of the following
  - Periodic ranging TOs
  - RR contention slots
- The new BS informs old BS (handshake) and the rest of Associated BSs on the HO. Also the network is informed for updating the IP routing paths [depends on the type of mobility support in the IP network]
- BS sets up connections to the SS
- After all that BS and SS continue regular operations.

Handover Solution

Handover Solution – Cont.